

1. A method for selectively etching a layer of material over a substrate, said method comprising:

defining an etching pattern on said layer of material;

5 placing said substrate containing said layer of material into a reactive chamber;

introducing an etching gas into said chamber;

providing a power to said substrate to induce a plasma in said gas;

and

10 changing the operating parameters of said reactive chamber during the etching of said material to selectively etch said layer of material.

2. The method according to claim 1, wherein said method includes selectively controlling deposition on a first position of a first material having a first aspect ratio while continuously etching a second position of a second material having a second aspect ratio, wherein said  
15 first aspect ratio is less than said second aspect ratio.

3. The method according to claim 2, wherein said first aspect ratio is less than or equal to 5.

4. The method according to claim 2, wherein said second aspect ratio is greater than or equal to 3.

5. The method according to claim 3, wherein said first aspect ratio is from about 0.5 to about 5.0.

5 6. The method according to claim 4, wherein said second aspect ratio is from about 3.0 to about 20.0.

7. The method according to claim 1, wherein said etching gas includes a fluorocarbon gas.

8. The method according to claim 1, wherein said etching gas  
10 includes a hydrofluorocarbon gas.

9. The method according to claim 1, wherein said etching gas includes a gas selected from the group consisting of  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{C}_4\text{F}_8$ ,  $\text{C}_3\text{F}_8$  and  $\text{CHF}_3$ .

10. The method according to claim 8, wherein said etching gas  
15 includes  $\text{CHF}_3$ .

11. The method according to claim 1, wherein method includes etching a self-aligned contact.

12. The method according to claim 2, wherein changing the operating parameters of said reactive chamber during the etching includes  
20 changing a DC bias voltage from a first voltage to a second voltage during a predetermined period while etching said material layer.

13. The method according to claim 12, wherein said DC bias voltage is pulsed on a duty cycle of from about 10 % to about 90%

14. The method according to claim 13, wherein said pulsed DC bias voltage is obtained by modulating a source power.

5 15. The method according to claim 13, wherein said pulsed DC bias voltage is obtained by modulating a source power, a bias power voltage or a combination thereof.

16. The method according to claim 2, wherein said predetermined period is calculated according to a first relative deposition rate and a first  
10 relative etch rate of said first material, and to a second relative deposition rate and a second relative etch rate of said second material.

17. The method according to claim 12, wherein said DC bias voltage is changed between about 0 volts and about 300 volts.

18. The method according to claim 17, wherein said DC bias  
15 voltage is changed between about 10 volts and about 80 volts.

19. The method according to claim 12, wherein said first voltage etches material on said first position of said first material and said second position of said second material and said second voltage deposits material on said first position while continuously etching said second position.

20. A method for etching a self-aligned contact, comprising:

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creating a patterned photoresist over a dielectric layer on a substrate, said substrate having spaced structures thereon, said patterned photoresist having an opening in alignment with the space between said spaced structures;

5 placing said device into a reactive chamber;

introducing an etching gas into said chamber;

providing a DC bias voltage to said substrate; and

changing said DC bias voltage from a first voltage to a second voltage during a predetermined period while etching said self-aligned

10 contact.

21. The method according to claim 20, wherein said method includes controlling deposition on a first position of a first material having a first aspect ratio while continuously etching a second position of a second material with a second aspect ratio between said structures,

15 wherein said first aspect ratio is less than said second aspect ratio.

22. The method according to claim 21, wherein said first aspect ratio is less than or equal to 5.

23. The method according to claim 21, wherein said second aspect ratio is greater than or equal to 3.

24. The method according to claim 22, wherein said first aspect ratio is from about 0.5 to about 5.0.

25. The method according to claim 23, wherein said second aspect ratio is from about 3.0 to about 20.0.

5 26. The method according to claim 20, wherein said etching gas includes a gas selected from the group consisting of a fluorocarbon gas and a hydrofluorocarbon gas.

27. The method according to claim 20, wherein said etching gas includes a gas selected from the group consisting of  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{C}_3\text{F}_8$ ,  $\text{C}_4\text{F}_8$  and  $\text{CHF}_3$ .  
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28. The method according to claim 26, wherein said etching gas includes  $\text{CHF}_3$ .

29. The method according to claim 20, wherein said DC bias voltage is modulated on a duty cycle of from about 10 % to about 90%

15 30. The method according to claim 29, wherein said DC bias voltage is obtained by modulating a source power.

31. The method according to claim 29, wherein said DC bias voltage is obtained by modulating a source power, a bias power or combinations thereof.

20 32. The method according to claim 20, wherein said pulsing period is calculated according to a first relative deposition rate and a first

relative etch rate of said first material, and to a second relative deposition rate and a second relative etch rate of said second material.

33. The method according to claim 20, wherein said DC bias voltage is modulated between about 0 volts and about 300 volts.

5 34. The method according to claim 33, wherein said DC bias voltage is modulated between about 10 volts and about 80 volts.

35. The method according to claim 20, wherein said first voltage etches material on a first position of a first material having a first aspect ratio and a second position having a second aspect ratio, wherein said first aspect ratio is less than said second aspect ratio, and said second voltage deposits material on said first position while continuously etching said second position.

10 36. An integrated circuit device wherein said device is selectively etched by a method, comprising:

15 placing said device into a reactive chamber;

introducing into said chamber an etching gas;

providing a DC bias voltage to said substrate; and

modulating said DC bias voltage from a first voltage to a second voltage for a predetermined pulsing period to selectively etch said device.

37. The device according to claim 36, wherein said method includes controlling deposition on a first position of a first material having a first aspect ratio while continuously etching a second position of a second material with a second aspect ratio, wherein said first aspect ratio is less than said second aspect ratio.

38. The device according to claim 37, wherein said first aspect ratio is less than or equal to 5.

39. The device according to claim 37, wherein said second aspect ratio is greater than or equal to 3.

40. The device according to claim 38, wherein said first aspect ratio is from about 0.5 to about 5.0.

41. The device according to claim 39, wherein said second aspect ratio is from about 3.0 to about 20.0.

42. The device according to claim 36, wherein said etching gas includes a fluorocarbon gas.

43. The device according to claim 36, wherein said etching gas includes a hydrofluorocarbon gas.

44. The device according to claim 36, wherein said etching gas includes a gas selected from the group consisting of  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{C}_3\text{F}_8$ ,  $\text{C}_4\text{F}_8$  and  $\text{CHF}_3$ .

45. The device according to claim 43, wherein said etching gas includes CHF<sub>3</sub>.

46. The device according to claim 36, wherein said device includes a self-aligned contact etched thereon.

5 47. The device according to claim 36, wherein said bias voltage is modulated on a duty cycle of from about 10 % to about 90%

48. The device according to claim 36, wherein said modulated DC bias voltage is obtained by modulating a source power.

10 49. The device according to claim 36, wherein said modulated DC bias voltage is obtained by modulating a source power, a bias power or combinations thereof.

50. The device according to claim 36, wherein said predetermined pulsing period is calculated according to a first relative deposition rate and a first relative etch rate of said first material, and to a second relative  
15 deposition rate and a second relative etch rate of said second material.

51. The device according to claim 36, wherein said bias voltage is modulated between about 0 volts and about 300 volts.

52. The device according to claim 51, wherein said bias voltage is modulated between about 10 volts and about 80 volts.

20 53. An apparatus for aspect controlled selective etching comprising;



a plasma etching chamber including a supported electrode;

a plasma induced bias voltage on said electrode; and

a bias voltage modulator for modulating the DC bias voltage

between a first voltage and a second voltage, wherein said first voltage is

greater than the voltage at which no etching occurs and said second

voltage less than the voltage at which no etching occurs.

54. The apparatus according to claim 53, wherein said apparatus is a high voltage plasma apparatus.

55. The apparatus according to claim 53, wherein said high power plasma apparatus has a source power of from about 400 to about 1500 watts.

56. The apparatus according to claim 54, wherein said apparatus is an inductively coupled plasma apparatus.

57. The apparatus according to claim 54, wherein said apparatus is an electron cyclotron resonance apparatus.

58. The apparatus according to claim 53, wherein said apparatus operates at a pressure of from about 2 to about 40 mTorr.

59. The apparatus according to claim 53, wherein said bias voltage modulator has a duty cycle of from about 10% to about 90%.

60. The apparatus according to claim 53, wherein said bias voltage is varied from between about 0 volts and about 300 volts.

61. The apparatus according to claim 53, wherein said plasma is a fluorocarbon gas provided to said reactive plasma chamber by a plasma source.

62. The apparatus according to claim 53, wherein said bias voltage modulator modulates the source power.

63. The apparatus according to claim 53, wherein said bias voltage modulator modulates the bias power.